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ABSTRACT

The Multnomah (Oregon) County Intermediate Education District conducted a three year project to develop a computer-based test development resource for classroom teachers. It sought: 1) to identify instructional objectives for various curricula and grade levels; 2) to develop a pool of test items to measure attainment of objectives; 3) to design a computer system for the storage and retrieval of items; 4) to conduct in-service teacher training for system usage; 5) to improve instruction in the participating schools; and 6) to disseminate information about the project. More than 32,000 instructional objectives and test items were developed, stored in a computer system on magnetic tape, and made available to teachers. More than 400 teachers were familiarized with the system. Finally, an inexpensive and simple telephone-mail communication system was devised. Participating students showed marked academic achievement. The system was found to need a complete sets of materials for continuous usage to allow faster selection, communication, and retrieval of material, and teachers needed to gain user experience. In addition, less specific objectives for group instruction should be developed, and the appropriateness of test items for particular objectives must be validated. (For related document, see EM 011 338.) (PB)

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COMPUTER-BASED TEST DEVELOPMENT CENTER PROJECT

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Introduction

This final report for the Computer-Based Test Development Project (COMBAT) is divided into four sections. The statistical report, which includes technical and fiscal information, is found in the first section. The second section is an evaluation of the project and discusses overall project objective attainment as well as a discussion of activities of each of the three project years. Information regarding dissemination activities is found in the third section and includes accounts of efforts to inform persons in the local project area and those which were focused at a national audience. The fourth section of this report contains conclusion with recommendations for further research.

During the past three years, three agencies have worked to develop a resource for classroom teachers. Multnomah County Intermediate Education District, the grantee, has been responsible for the fiscal and administrative tasks. The Teaching Research Division of the Oregon State System of Higher Education has been responsible for the development of the project and served as a liaison between the project and participating school districts. The computer storage and retrieval system and all other computer related tasks were confronted by the Data Processing Department of the Portland Public School District. The COMBAT Project was sponsored by the Metropolitan Area Testing Program Board (MATPB), an aggregate of over seventy school districts in the metropolitan Portland area who have combined in an attempt to improve their testing programs. An advisory board, consisting of members from the MATPB, served as technical consultants to the project. They were of particular assistance in disseminating information to the schools in the project area.

By the end of the third year of the project, 36,239 instructional objectives and test items were produced. These materials were stored on magnetic tape using a set of content outlines which served as key words for storage and retrieval purposes. A communication system was designed so that classroom teachers could receive printouts of materials either on hard copy or on ditto masters for easy duplication. All social studies, language arts, mathematics and science teachers who teach in grades 4-12 received some type of orientation about the project. Well over 250 teachers participated in some form of inservice training for the project to either produce new material or field test previously prepared material.

While the development is not yet completed, a beginning has been made and with continued development, a dynamic and flexible resource can be developed. This early development supports the concept of creating a computer-based test resource which can serve to help plan and evaluate the myriad of instructional approaches being presently offered by school districts.

Part II Evaluation Report
Section A

The evaluation report is divided into two sections. The first section discusses the project objectives, project activities, and evaluation design as presented in the original proposal and the First and Second Annual Reports. The second section addresses questions outlined in the final report guidelines provided by the Oregon State Department of Education.

Six general objectives, presented in the original proposal, are discussed. A summary of each year's contribution to the attainment of the objective will follow, plus a general summary of the total three years.

1. To identify the specific objectives of instruction in all elementary and secondary school curricular areas for all grade levels.

First Year

In December, 1967, work sessions were conducted to train classroom teachers in the writing of instructional objectives and items for fourth, fifth and sixth grade social studies. Other sessions were planned, with teachers gathering on Friday and on weekends to continue adding materials to the computer file. However, because the project funds did not provide payment for substitute teachers to release classroom teachers, and a failure to reimburse teachers for their time, this procedure was only partially successful in producing objectives and items. Approximately 500 instructional objectives and test items in the social studies area were developed.

Following this initial development two decisions were made, (1) to investigate the best approach to training teachers to write objectives

and items and (2) that the curriculum would be initially limited to 4th, 5th and 6th grade social studies. It was found that teachers who had special in-service training in writing objectives and items could prepare superior material, in terms of clarity of objectives, to teachers with no special training. The level of the development was expanded during the summer, 1968, with workshops designed to develop objectives and items for social studies as taught in 4th, 5th and 6th grade.

Second Year

During the second year of operation, workshops, some of which offered graduate credit, were conducted in each of the three metropolitan counties. A total of 225 teachers contributed over 13,000 man-hours of work in development of objectives and appropriate test items during the second year of operation. These teachers represented all grade levels and subject disciplines and prepared material based on their teaching assignments.

The objectives produced were evaluated in terms of the specifity of each objective, the number of objectives written, and the pervasiveness with which the objectives covered the particular content areas. Every objective was examined by a member of the COMBAT staff for quality in terms of clarity. Also, each item was examined by the COMBAT staff in terms of its relevance to each specific objective. Approximately 8,000 objectives and test items were stored in the computer by the end of the second year and services to classroom teachers were initiated. Additional materials were added to the computer as content outlines were developed for storage and retrieval purposes.

Third Year

Because many of the participating school districts in the COMBAT Project contained only secondary grades (7-12), it was necessary to add materials for students at these levels so all teachers in the three county area could obtain experience with the system. To increase the quantity of objectives and items available to teachers in social studies, language arts, mathematics and science, it was necessary to incorporate the following procedures:

1. Solicit teachers' tests and objectives by requesting teachers to supply the COMBAT staff with tests and objectives used in their classrooms.
2. Continue to conduct workshops for classroom teachers who provide objectives and items.
3. Solicit selected published tests that are of high quality and have content validity for the target population. (The two main sources used were science items published by Education Testing Service and Portland Integrated Science Project.)

When teacher and publisher tests were received, each item was edited by the COMBAT staff to insure conformity to the item and computer formats. Additionally, an instructional objective was written for each item. These objectives and edited items were prepared by trained editors working 8,000 man-hours.

Approximately 27,000 objectives and items were added during the third year of the project in the areas of language arts, science, mathematics and social studies in grade levels four through twelve. Many of these items were prepared by teachers during the Spring and

Summer of the second project year and not added until content outlines were prepared early in the third year.

Summary

Over 36,000 objectives and items have been stored in the computer file with the breakdown of objectives and items in each of the four areas as follows:

Social Studies	15,000
Language arts	9,200
Mathematics	6,000
Science	5,700
Others	350

Grade levels 4-12 were developed in the four major subject areas, although some materials for students in grades 1-3 were prepared by teachers in workshops and added to the files. Each of these objectives and items were edited by a member of the COMBAT staff to insure the proper computer format and that the objectives and items fit the established project guidelines.

2. To develop a pool of test items appropriate for assessing the attainment of the instructional objectives so identified.

First Year

Both constructed and selected response type items were prepared to correspond to the verbs used in the instructional objectives. Many items were designed to make use of auxiliary materials such as: maps, diagrams, pictures, etc. It was originally planned that the project activities would insure the development of ten thousand such test items per year. From December 1, 1967, until July 1, 1968, approximately two thousand test items were generated.

Second Year

Both quantitative and usability criteria apply in evaluating this objective. Approximately 8,000 items are stored in the computer at the end of this fiscal year, June 30, 1969. Other materials were prepared but not added until the third year because content outlines needed to be developed.

A questionnaire (see attachment A) was submitted to 55 teachers in participating schools during this year of activity. When asked if they would use the items in their classroom, 96% of the teachers responded in a positive fashion.

Third Year

By June 30, 1970, a total of approximately 35,000 items were stored in the computer. Each of these items and accompanying objective has been examined by a member of the COMBAT staff and edited so that the items fit the computer format and also is identified as a multiple choice, true-false, matching, short answer, and essay. The large increase in materials production can be explained by the fact that many sets of materials were not stored in the computer pending the development of content outlines.

Summary

For a summary of objective number 2 please read the summary statements as outlined under objective number one; as both objectives one and two address the same general areas.

3. To design and operate the computer system necessary for the implementation of the test development activities.

First Year

During first year a rudimentary system was designed so that stored materials could be requested. Operation of the computer system during the first year was restricted in scope.

The communication system was designed so that all requests could be made by telephone. Using the telephone, the requesting teacher interacted with a telephone receptionist and provided the information pertinent to the retrieval of stored materials. The requests taken during the day were programed and retrieved during evening hours.

Upon receiving the materials from the computer center, the teacher could eliminate those items or objectives which were not relevant and phone the computer center to have appropriate materials printed on ditto masters for reproduction in the local school.

Second Year

The system began operation using materials produced in teacher workshops, in the areas of 4th, 5th and 6th grade social studies. In order to initiate use of the system, teachers in each of the counties were contacted individually by a staff member. They were asked to use the system and provide feedback based on their experiences. From their responses and those of other teachers trying COMBAT, the following information was compiled about the computer system.

a. The length of time to receive the first printout was 2 days.

b. Most teachers (71%) stated they found no problems calling COMBAT Services. Others experienced a busy line.

c. The average time teachers spent requesting a test was 4.6 minutes.

d. An overwhelming majority of teachers (96%) said they would use the COMBAT materials they requested in their classrooms.

Third Year

The system was expanded to grade levels four through twelve in the areas of social studies, language arts, science, and mathematics. General outlines were developed for all these areas to aid the teachers in their selection of materials. These outlines are shown (in Attachment B) and were distributed to all fourth, fifth and sixth grade teachers and teachers who taught language arts, social studies, science and mathematics in the upper grades (7-12) in Clackamas, Multnomah and Washington Counties.

Summary

The Portland Public School Computer Center has done an adequate job of keypunching, storing, and retrieving objectives and tests for teachers. From the recommendations of various users, there was a need to decrease the turn-around time between a teachers' first call and the receipt of the printed materials. An ideal system might utilize remote consoles located in various schools which could provide the teachers a direct tie-in with the computer and print out tests on a teletype which would enable them to preview the items. However, this would add greatly to the cost of a computer-based system.

4. To conduct the necessary in-service training required to insure optimum utilization of the test development center.

First Year

During this first year of operation, 75 teachers became directly involved with the project in the development of objectives and items

and system tryouts. Key personnel in each participating district were thoroughly briefed in the use of the COMBAT system.

Second Year

In-service training sessions in which graduate credit was granted to the participants were conducted in every county in the metropolitan area. These programs reached 225 teachers, all of whom developed competency in using the system as well as item and objective writing procedures. Additionally, visitations were made to school districts and school buildings where orientation sessions were conducted during in-service days and after regular school days.

Third Year and Summary

Orientation sessions in schools were intensified during the third year. Advisory groups of secondary teachers (175) were oriented and encouraged to use and contribute to the COMBAT system. For a detailed report of the third year's activities and summation report, please read Section A of the Dissemination Report in this final report.

5. To improve the overall effectiveness of instruction in all curricular areas and grade levels represented in elementary and secondary schools in the participating districts.

First Year

The major objective of the project was to develop a testing system which would be superior to the alternatives presently available to classroom teachers. Additionally, a secondary objective was to include instructional objectives to aid instructional planning. During the first year of the project, teachers and administrators in the participating districts

were informed of the rationale of the COMBAT Project. They indicated a general impression that by using computer-assembled objectives and test items that improvements could be made in the overall effectiveness of their instruction.

Second Year

Reports indicate that use of COMBAT has had a profound effect on the instructional practices of some teachers, mainly in social studies at grade levels 4, 5 and 6, but this objective was not appropriately evaluated. It seemed to be difficult to prepare and store adequate amounts of materials that teachers could use the system totally for planning and evaluating their instruction.

Third Year

No formal evaluation of this objective was conducted. There was a social studies project conducted that attempted to provide insight into this objective and is summarized later in this evaluation section. As stated above, the project had an effect on the instructional practices of some teachers. They became more aware of the relationship between instructional objectives and test items.

Summary

There was an attempt to determine the effectiveness of COMBAT in the social studies area, grade levels 4, 5 and 6 which is summarized in a different section of this evaluation report. The reason for not completely evaluating this objective was that complete materials files, except in social studies, were not available. While no actual measure was taken to determine the instructional effectiveness of COMBAT, it was

reported by teachers that they had become more aware of the role of instructional objectives in their planning of instruction.

6. To conduct the necessary informational and dissemination activities which will make this system a model for similar centers to be located throughout the United States.

Summary

A detailed description of all dissemination activites for the duration of the project is described in the Dissemination Report of this final report. Also, a summary of school districts adopting part of the COMBAT system is given in Section B of this Evaluation Report.

Third Year Objectives

The following objectives were established in the Second Annual Report as additions to the six general objectives previously discussed. A listing of these secondary objectives and a discussion of their attainment will follow.

1) To increase the files by at least 20,000 objectives and items in grade levels four through twelve in the following subject areas: mathematics, science, social studies, and language arts.

The file was increased by approximately 28,000 objectives and items in grade levels 4 through 12 in the areas of mathematics, science, social studies and language arts. A breakdown of the total number of objectives and items can be found under the summary of the evaluation of the first general objective.

This apparent increase in production of objectives and items can be attributed to the following reasons:

a) Copies of teacher-produced tests and instructional materials were obtained from teachers in the three county area. These items were edited by a professional staff so that they could be incorporated into the COMBAT system. Instructional objectives were also included with each test item prior to storage.

b) Objectives and items were exchanged with research groups doing similar work. The largest exchange took place with Instructional Objectives Exchange, (IOX), at UCLA. (For a detailed description of all exchanges see Section B of this Evaluation Report.)

c) Copies of tests and materials have been received from school curriculum committees, Portland Integrated Science Project, and through regular publisher channels, i.e., ETS. These tests are edited by the COMBAT staff and instructional objectives are written to accommodate each item. After editing, they are included in the COMBAT file.

d) Workshops have been conducted so that classroom teachers were trained to write objectives and items to be placed in the COMBAT file. Approximately 500 man hours were utilized for workshop efforts this final year. These teachers were reimbursed for their efforts.

2) To introduce additional teachers to the COMBAT system and encourage regular usage by teachers at all grade levels.

Orientation materials have been produced in the forms of a slide-tape presentation, pamphlets and sample materials. These materials have been used primarily with teachers and administrators in the project area. For a detailed description of the number and kind of presentation presented, see the Dissemination Report of this report.

3) To increase the number of schools actively using the COMBAT system from 79 of the possible 250 elementary schools in the MATPB area to include 150 elementary schools and at least one-half of the secondary schools in the MATPB area.

A total of 148 elementary schools and 54 of the 64 secondary schools have utilized the COMBAT system in the MATPB area. Orientation sessions were conducted for superintendents, principals, curriculum supervisors, and teachers. Also, teacher orientation packages were distributed to all teachers through the Intermediate Education Districts. A more detailed description of these activities is described in the Dissemination Report.

4. To provide an index of objectives and items listed by content areas for the grade and subject matter areas for which materials are developed.

A complete outline representing all the objectives and items for each grade level and subject area was constructed and is shown in Attachment B. These outlines were disseminated to all teachers in the MATPB area through the IEDs. More complete indexes including frequency counts are in the final stages of completion.

In addition to the six project objectives listed in the original proposal and four additional objectives stated in the Second Annual Report, there were two other sets of activities proposed which supplemented these objectives. One set of these activities was listed in the First Annual Report, while the other set was listed in the Second Annual Report.

There were three changes in project activities listed in the First Annual Report for the second year of the project. The first change was to

increase the number of teacher participants beyond the 200 originally planned for. There were 225 teacher participants during the second year. Although this exceeds the 200 originally planned for, the increase of 25 teacher participants was much lower than had been anticipated. Lack of district funds to release teachers for workshops and the limited amount of released time teachers reported, are two possible reasons why the number of teacher participants did not appreciably exceed the 200 originally planned for.

The second change listed in the First Annual Report for the second year was to exceed the production of 10,000 items originally planned for. It was felt that this could be accomplished by the increased number of teacher participants that were expected for the second year. As was noted earlier, the increased number of teacher participants did not materialize and the number of items produced in the second year fell 4,000 short of the 10,000 originally planned for. The small number of items (6,000) produced during the second year can probably be attributed to (1) amount of staff time involved in teacher training, (2) underestimation of the length of time necessary to produce the items and (3) the training required to bring teachers up to the skill level necessary for item production.

The third change outlined in the First Annual Report for the second year was the inclusion of teacher participants from more grade levels and subject matter areas. During the first year the emphasis was placed on fourth, fifth and sixth grade social studies teachers. During the second year, changes did occur, and teachers from grades 4-12 for mathematics, science, language arts and social studies were included in the workshops.

In the Second Annual Report a major change in the procedures of item

development was proposed. During the first two years, teams of teachers were used to produce objectives and items. Although quality items and objectives were produced, the process was slow and could not cover, even minimally, all the curricular areas in the public schools. Four major efforts were initiated for the third year to increase the number of objectives and items. These changes are listed under objective number one in the previous section and their implementation during the third year made it possible to increase the COMBAT files by 28,000 items and reach the goal of 35,000 items which had been proposed.

In addition to the major changes in item production, three education needs were outlined in the second annual report. The first two educational needs; (1) assessing student performance prior to and following instruction, and (2) planning instruction, using specific performance objectives; were accomplished with the help of 20 teachers in the winter of 1969-70. The 20 teachers were involved in a Social Studies Project using the COMBAT materials which required them to (1) select instructional objectives for a particular unit of instruction, (2) request test items which measured these objectives, (3) give a pre-test over the proposed unit of instruction, and (4) give a post-test after the unit of instruction was completed. Although most of the teachers felt this procedure was useful in planning and evaluating instruction, they were concerned about the time required to carry out such a program. Teachers also would have liked objectives tailored more to their specific needs. This study demonstrated the potential of the COMBAT system for meeting the above two needs.

The third need listed in the Second Annual Report was to utilize

computer-aided instruction in educational settings. Although usage of the system was not as great as had been hoped, an increasing number of teachers used the system as time progressed. Several orientation procedures were used to acquaint teachers with the COMBAT system. A slide tape was developed which was shown to teachers by COMBAT staff and Advisory Board to the project. Orientation packages were sent to the teachers in grades 4 through 12 in the areas of mathematics, science, language arts and social studies. In-service training was continued through the summer of 1969. A more detailed account of the efforts to increase knowledge and usage of computer-aided instruction such as COMBAT can be found in the Dissemination Report.

Proposed Project Evaluation

The original proposal listed ten major evaluation questions which were to serve as guidelines in assessing project effectiveness. At the time these questions were formulated it was realized that they were considered as tentative recommendations rather than firm commitments. The goals alluded to in the ten questions could be firmly identified only upon initiation of the project, since experience with a system like COMBAT was not available at that time. In addition, the ten questions were designed to evaluate the project over a projected seven year period, instead of the three years which have occured to date. The six project objectives stated in the original proposal and their modifications in the first and second annual report provided more realistic evaluation guidelines than did the ten evaluation questions. However, each of the ten questions will be discussed and whatever information is available will be reported. Again it should be emphasized that the six objectives

and their modifications discussed earlier in this report are the primary basis for project evaluation.

The first question, "Do test users characteristically identify 90% or more of test items provided as relevant to their request?" was evaluated by a questionnaire sent out during the second year of the project. Of the teachers responding to the questionnaire, 96% said they would not hesitate to use the items in their classrooms and that the items were relevant for the grade level they taught.

The second question, "Do the majority of teachers in appropriate subject matter areas in participating schools routinely utilize the test development services of the Center?" can be answered by checking the utilization files maintained for all users. The number of users listed in the files totaled 470 which was approximately 10% of the number of teachers who had access to the system. It is obvious that a majority of the teachers did not use the system. Furthermore, 215 of the 470 teachers who did use the system used it only once. It can be seen that the COMBAT system did not achieve even routine usage by the teachers it was designed to serve. Other sections of this report provide possible explanations for the low usage rate of the system.

The third question, "Is there evidence of increased school participation in the project?" can be answered by checking the school address of the users. At the end of the second year, 79 of the possible 250 elementary schools had participated and this number was increased to 148 at the end of the third year. The number of secondary schools participating increased from almost zero to 54 out of a possible 64 from the second to the third year. The dramatic increase in school participation during the

third year can probably be attributed to the inclusion of secondary school items previously not available. Although the number of users was small, there was a substantial increase in school participation from the second to the third year.

The following evaluation questions and the procedures suggested for assessing them are numbered as they appeared in the original proposal. Information was not gathered to assess these questions because project objectives and subsequent modifications were considered to be the major foci of the project as it evolved over the three year period.

4. Are Center-produced tests judged to have superior validity when compared to published tests by test users?

   Samples of users will be asked to compare the validity of tests provided to them by the Center with such published tests that would ordinarily be used in place of Center-produced tests.

5. Are test utilization patterns of participating schools superior to patterns in nonparticipating schools?

   Participating and nonparticipating schools will be matched on such variables as size, type of locale, and per-pupil expenditure. Comparisons of test employment will be made to determine types of tests used, frequency of use, and testing purposes.

6. Do teachers in participating schools report increased capacity to provide improved instructional practices?

   Samples of users will be interviewed by neutral interviewers to identify their reactions to the program. Care will be taken to gather candid evidence of the effects of the Center on the teachers' actual work day.

7. Do the curricular objectives covered in the Center significantly exhaust each curricular area?

   When the Center staff is reasonably satisfied with its efforts in a given area, the objectives will be presented to an independent panel of experts in that area for study. The staff's opinion must be verified by the expert panel.

9. Are testing programs of participating schools expanded as a result of Center services?

   It is expected that the existence of the Center will permit participating schools to expand their testing activities without additional costs to them. All participants will be surveyed continually to determine the nature and costs of their testing programs.

The eighth question, "Are curricular objectives developed in the Center accepted, in substance, by other groups?" is addressed in Section B of this report. This section summarizes the requests made of the ways in which the materials were used.

The tenth question, "Do teachers creatively utilize the total features of the system provided?" can be answered by citing several brief anecdotes. These anecdotes should be considered illustrative of the variety of users to which the COMBAT system was used.

1. A fifth grade teacher made use of the COMBAT system by requesting large numbers of objectives. The objectives were made available to students so that they could sit down with their teacher and negotiate those objectives they wished to accomplish. The objectives were used to

stimulate student interest and provide a focus for independent study. It was the responsibility of the student (with the teacher's help) to locate and master the resources necessary to accomplish the objectives they had chosen to work on.

2. A fourth grade teacher in Oregon City used the test items as learning activities during class time. She had groups of students answering sets of questions followed by class discussion of all items. One of the outcomes of this procedure was that the entire class was able to identify items which needed editing and corrected the items for the Computer Center.

3. A ninth grade science teacher in Beaverton designed several instructional units using a pre-test - post-test strategy. He introduced units of heredity, weather, geology, and astronomy with a pre-test to assess the entry level of the students. Following formal instruction, he used a post-test to assess the students' gain on the units presented.

4. A group of social studies teachers in a school district in Clackamas County used the objectives as one of the resources in a curriculum revision project. They were able to order lists of instructional objectives, which had been prepared by a large number of teachers in the metropolitan Portland area, and include the ones which were most relevant for their curricular program.

Part II Evaluation Report

Section B

The COMBAT project will not be continued at the level of participation or scope upon which it has operated during the previous fiscal year. The largest of the participating districts, Portland Public Schools, plans to continue with the project in the future; however, they were not able to budget money to cover computer time and further developmental costs for this fiscal year. Many persons in the data processing and research departments feel that money will be available during the next fiscal year.

All participating agencies (Portland Public Schools, Teaching Research Division and the Intermediate Education Districts in Clackamas, Multnomah and Washington Counties) will have access to the computer program documentation, data tapes and auxiliary materials. This accessibility will allow them to implement the project in part or whole at their discretion. Formal implementation plans are not yet known.

There are obvious reasons that the COMBAT project, as it has developed over the past three years, will not be continued. The principle reason for not continuing the project is that local funding from the participating districts did not materialize. Advisory Board members decided early in the second year of the project that the most plausible method of financing the project would be to place the proposal for continuation on county resolution in each of the counties (Clackamas, Multnomah and Washington). This strategy was followed and each county had a separate resolution to finance proportionate shares of the funds necessary to continue COMBAT

beyond the expiration of Title III funds. In order to pass resolution, the proposals needed to be approved by two-thirds of the total number of districts needed to contain over one-half of the total county school population. These resolutions did not pass in any of the counties.

Reasons for the lack of financial support from local sources are admittedly speculative. Nevertheless, it seems worthwhile to discuss the possibilities. The costs of merely developing instructional materials is significantly high; however, when coupled with necessary computer expenses the cost of developing a system similar to COMBAT is extremely high. The participating districts were not able to place such expenditures high on their priorities at this time. The districts simply have other fiscal priorities at the present time.

The lack of initial and continued classroom teacher support for COMBAT is another possible cause for lack of continuance. It is true that hundreds of classroom teachers were involved in COMBAT during the past three years. They were used as materials preparers, advisors, orienters and implementors. However, because of the short development time available and the enormity of the task, individual teachers could not make significant contributions.

A factor, which is related to the preceding one regarding teacher support of the project, addresses the problem of a balance between materials development and having an operating system. The developmental strategy used by the COMBAT project focused on development and providing service to teachers nearly simultaneously. This practice had some negative effects among the users. An attempt was made to "sell" an idea to them (the COMBAT concept) and ask them for cooperation. Many teachers were willing to request materials, but when requests could not be filled,

because of insufficient development, teachers became disillusioned. The inability of the system to provide service to some teachers for specific requests became a major problem in gaining broad support among the users of objectives and test items, the teachers.

Because the COMBAT project was sponsored by the Metropolitan Area Testing Board (MATPB) only the participating school districts in the MATPB program have actually implemented the project. Many requests for information about the project were received from Oregon school districts. These districts received orientation materials, including sample test items and objectives. No districts within the State of Oregon have actually implemented the project or parts of the project.

Many interested persons representing a variety of educational agencies have been interested in the development of COMBAT. Several agencies have received materials and, to our knowledge, are using the materials. One Title III project entitled "Evaluation for Individualized Instruction" operated by the Downer's Grove, Illinois, Public Schools requested and received approximately 8,000 social studies objectives and test items. Additional computer software materials and system documentation was provided to the Downer's Grove District.

Social studies objectives and test items were requested by the Instructional Objectives Exchange (IOX) operated by the Graduate School of Education at the University of California at Los Angeles. They received approximately 4,500 items and contributed several hundred mathematics items to the COMBAT system.

Broward County Education District in Fort Lauderdale, Florida, received 2,500 social studies test items and have requested the objectives

to match the items previously received. They have also requested a copy of the computer tapes containing all COMBAT stored materials.

Numerous other agencies have requested complete sets of all stored material plus computer storage and retrieval documentation. These agencies will receive all requested materials and will be charged for the materials' costs and computer time required to copy the tapes. Agencies which have made requests include the New York State Department of Education, Ontario Institute for Studies in Education, and Bloomfield Hills (Michigan) Public Schools.

Part III Dissemination Report

Section A

During the project many different dissemination activities were conducted for persons with varying responsibilities in the participating school districts. Early in the project history all principals in the three-county area were sent information about the project. They were encouraged to use the system and to encourage their teachers to try the materials which had been stored. As additional materials were stored in the computer, teachers in the corresponding grade levels were contacted. General orientation pamphlets, which included sample test items, were mailed to all fourth, fifth and sixth grade teachers in February of 1969. At that time the COMBAT file consisted of approximately 3,000 social studies items prepared specifically for 4th, 5th and 6th grade students. These orientation packages included descriptive information about the project; a test request form, with directions for use; and sample materials. These packages were distributed through the Intermediate Education Districts, (IED) in Clackamas, Multnomah and Washington Counties.

When materials were developed in additional subject matter areas (science, mathematics and language arts) new orientation packages were prepared. These packages, which included the same materials as the original packages, plus content outlines, were sent to all teachers in grades 7 - 12 whose teaching assignments were social studies, science, mathematics or language arts. These materials were also sent through the county IED office mail systems in Clackamas, Multnomah and Washington Counties.

Group orientation sessions for teachers and administrators were conducted throughout the duration of the project. One staff member spent approximately 60% of his time orienting teachers to the project. A slide-tape package was prepared and multiple copies used by Teaching Research Division, Multnomah County IED and Portland Public School District personnel.

In order to obtain advice from groups of secondary teachers and inform them about the availability of COMBAT materials, advisory teams, consisting of two teachers from each secondary school in the three-county area were formed. These teachers were asked to:

1. Become familiar with the COMBAT system and its uses.
2. Order test items and objectives for classroom use.
3. Orient fellow teachers to the COMBAT system.
4. Donate and collect high quality tests and objectives from fellow teachers to be stored in the computer.
5. Provide feedback concerning the operation of the COMBAT system through responding to interviews and questionnaires.

These teachers and their principals were oriented in one of four meetings held in the later part of October, 1969. At that time they received all orientation materials necessary for ordering materials from the computer center. Over 175 people attended one of the meetings.

In-service training was conducted primarily during the second year of the project. This training was used primarily for the following reasons:

1. To train teachers in writing instructional objectives.
2. To train teachers to write test items for instructional objectives.

3. To familiarize teachers with the materials request procedures in the COMBAT project.

Over 250 teachers and administrators have received in-service training during the duration of the project. In some cases persons received graduate credit for the classes in which they enrolled. These classes entitled "Measurement of Educational Objectives," were arranged through the Division of Continuing Education (DCE). Classes were offered to teachers in each of the three participating counties (Clackamas, Multnomah, and Washington). The in-service training conducted during the third year of the project was concentrated on a social studies project. During this project, groups of 4th, 5th and 6th grade teachers tried to plan and evaluate their social studies instruction, using only COMBAT stored material for planning instruction and evaluating student outcomes.

Methods of Dissemination

Comprehensive dissemination activities focused at populations outside the metropolitan three-county area consisted of various communication devices. Apart from the regular letter correspondence concerning the project development, many additional forms of printed media were produced to supplement the general informational activities. In addition, several national conferences were attended for the purpose of communicating information accumulated through project experiences. The various methods and means of disseminating information about the COMBAT project will be described in the paragraphs that follow.

Of prime interest to persons who had a continuing interest in COMBAT was the Newsletter published every two months. The Newsletter content

was written by staff members who were engaged in project development and by teachers who were utilizing COMBAT materials in their classroom. The purpose for this publication was to keep interested parties informed about the continuing development of the project.

COMBAT's conceptual implications and developmental activities over the life of the project were exchanged at several national educational conferences. At the American Educational Research Association, (AERA), national meeting in Chicago 1968, a paper entitled, "COMBAT Boon or Bane" was presented and told of applications of computer technology to the instructional process. In early 1970, presentation of the project was given to the American Association of School Administrators held in Cincinnati. A symposium on computer-based testing was held at the National Council for Measurement in Education, (NCME), in Minneapolis, Minnesota during March of 1970. Five papers were presented concerning current aspects of computer-based testing. A presentation of the COMBAT Project operation was made at the annual meeting of the participants in the Educational Systems for the Seventies, (ES'70), held in Santa Fe, New Mexico in late March, 1970.

Methods of dissemination within the state of Oregon were aimed primarily at persons who were project participants. An article was written and prepared by the COMBAT staff for publication in Oregon Education, the official publication of the Oregon Education Association. Several orientation sessions were conducted in conjunction with regular courses conducted under the auspices of the Division of Continuing Education. A meeting was also held with the State Audits Committee. Exploration of resources for expanding the COMBAT project resulted in

meeting with the General Education Division of the State Department and the Executive Board of the Oregon Association for Supervision and Curriculum Development. Cooperation among various research or educational institutions was conducted by disseminating materials in a reciprocal manner.

Successful Dissemination Activities

With most of the dissemination and orientation activities focused at the potential users of the COMBAT system, it was observable that teachers have a curious, but apprehensive attitude toward a computer-based testing program. Teachers are aware of the increasing potential of computerized teaching methods. In some cases, these methods were thought to impose a threat to an individual's initiative and creative teaching inspiration. Nevertheless, most teachers were receptive to the system as an effective resource for planning and evaluating learning activities.

Dissemination of information requires the cooperation of key personnel who are responsible for structural communication processes. The interest in carrying out these kinds of activities on the part of administration officials in various districts has been outstanding. The contributions of the COMBAT Advisory Board has been particularly noteworthy. These people have made sacrifices to accept responsibility in an effort to promote the project's objectives and to inform teachers of the instructional potential of the system.

In like manner, teachers and other organizations have been responsive to requests imposed upon them for materials that could be contributed, and therefore utilized, within the system. In these instances, many people have been involved in relaying requested materials to the personnel in charge of item bank generation.

COMBAT Final Report

Part III, Dissemination Report, Section B

DISSEMINATION AND PRODUCT MATERIALS

The following copy is a list of materials that were disseminated or produced during the duration of the project. Each of these items is discussed at length in the previous section of the Dissemination Report and is to be sent under separate cover to the Oregon Board of Education, Salem, Oregon.

Dissemination materials:

1. COMBAT Newsletter
2. Information brochures
3. Instructional materials request form
4. Instructional materials

Items produced:

1. Slide-tape package
2. Oregon Education Association Magazine article (December, 1969)
3. National Council on Measurement in Education: A Symposium Booklet (1970)
4. Oregon Association for Supervision and Curriculum Development Newsletter

Part IV

Conclusions and Recommendations for Further Research

The inclusion of this chapter seems appropriate for the final report of a three year developmental project. This chapter will address: project status and accomplishments; project weaknesses and recommendations for correction; and suggestions for further research.

During the operation of the Computer-Based Test Center (COMBAT) a computer system capable of storing and retrieving large amounts of information has been developed. Additionally a communications procedure between classroom teachers and the computer center was created. This development, supervised by Mr. Robert Coffin, Director of the Portland Public Schools Data Processing Center, was conducted by his staff at the Center. For their contributions to the project the Portland Public School District was reimbursed under a subcontract with the grantee, the Multnomah Intermediate Education District.

The materials, consisting of instructional objectives and test items, were stored on magnetic tape. They were arranged by sets of key words which were generated from content outlines developed prior to categorizing and storing material. This key word storage and retrieval system allowed users to use natural language when interacting with the system. This is seen as a definite strength of the project as classroom teachers had little time to learn other languages with which to interact with a computer system. The data file is described in attachment C in both fixed and print-image versions.

Another computer-related accomplishment of the project was the development of printout formats which were simple to read and as flexible

as possible for a variety of curricular offerings. Prior to any large scale development efforts, classroom teachers were consulted regarding possible test item types and formats for the instructional objectives and test items. While revisions of the instructional objective formats were made, these early formats proved to be very satisfactory. It was also decided that teachers would receive printouts of test items on ditto masters for later reproduction in the local school building. There were minor complaints about excessive use of school supplies to duplicate tests, but mailing the ditto masters, rather than multiple copies, from the Computer Center saved time and postage.

In the area of materials development the project made use of a variety of test items to correspond to the verbs of the instructional objectives. The Teaching Research Division, under a subcontract with Multnomah County Intermediate Education District, was responsible for the development of materials and implementation of the COMBAT system. True-false, matching, multiple choice, short answer, and essay items were prepared. Many of these items called for the use of charts, diagrams or maps -- these materials were prepared in the form of ditto masters and included in an auxiliary file. The items, which made use of this auxiliary material, were coded so that appropriate materials could be included with each test which was printed. (See attachment D for a copy of a sample set of objectives and a sample test.)

The prepared materials were purposefully not structured to any specific curriculum program. Since the project served over seventy separate school districts, materials had to be designed to be of maximum flexibility and applicability. The instructional objectives were constructed so that, in most cases, only one test item was appropriate

for the assessment of student attainment of the objective. The graphical aids stored in the auxiliary file were felt to be a definite project strength as teachers could assess behaviors which are difficult to measure using only computer-printed materials.

A communication system between the Computer Center and the classroom teacher was also developed. Using a combination telephone-mail system was found to have advantages over other types of communication. This system was much less expensive than using remote terminals and little orientation was needed to train teachers in the communication procedure. The calls to the Computer Center were received by telephone receptionists who were responsible for leading the teachers through the communication procedure. The role played by the receptionist is an extremely valuable one, since they represented the only contact with the project that most teachers had. We felt fortunate to have receptionists who were, by teachers' own admissions, extremely capable aiding teachers making requests. Materials placed in the mail were received by some teachers the day following mailing--other materials required two days to arrive. The average time to receive a printout of materials was generally two days.

The major accomplishment of the project was the development of a large compendium of material, over 36,000 items, and making it available to teachers across a broad geographical area. This sharing of materials between many districts of varying size did much to add to the resources available to teachers for planning and evaluating instruction. They could make use of material prepared by other teachers doing similar work in other school districts.

Deficiencies of the project need also to be identified and discussed. At the completion of any stage of developmental research, the developers

would like to make various modifications if allowed to do so. The COMBAT Project is no exception. The most serious weakness in the project was the incompleteness of the development. Because most curricular areas were not completely developed, continuous usage by a teacher was not possible. Only in the initial development area, social studies grades 4, 5 and 6, was the development complete enough to conduct systematic trials of the materials. This was accomplished by conducting a Social Studies Project in which twenty 4th, 5th and 6th grade teachers used the objectives and test items for planning and evaluating their instruction. Later they provided valuable information regarding their experiences with the project.

These teachers reported that too much time and effort was required to survey large numbers of objectives. Additionally they felt the objectives too specific and not consistent in terminology with curriculum materials they were accustomed to using. They did report, however, that using a pre-test - post-test instructional sequence, the students reported marked gain scores.

The reason that other development, in social studies, language arts, science and mathematics, was not completed was that there simply was not sufficient development time to complete the task. The strategy followed was to develop sufficient materials for all teachers in grades 4-12 such that they could obtain experience with the project. While this was accomplished, it would have been wiser to develop the project more slowly to allow systematic trials of all materials and to completely develop sections of the curriculum rather than allowing teachers access to partially developed areas.

Another system modification which needs to be made is to shorten the elapsed time from a teacher's call to the Computer Center and the receipt of the desired materials. When the number of requests per day began to average 15-20 requests, it was difficult to maintain the turn-around time from the original request to the receipt of material.

The specificity of the instructional objectives is an additional problem. Objectives of many different degrees of specificity are needed by most school districts. For example, educators need objectives which are extremely specific when developing self-instructional packages. Conversely, when a teacher is planning a unit of instruction for a group of students, the instructional objectives need to be less specific and could include different student alternatives for objective attainment and evaluation. COMBAT objectives were prepared to be specific in nature, therefore, teachers planning group paced instruction have had some difficulty using them.

The test items stored with each objective also need to be scrutinized. The grade level indicators attached to each item need to be empirically verified by systematically trying out the items with learners of varying ages and abilities. In addition item analysis procedures, based on the Rasch Model (designed to provide person-free item calibration and item-free person measurement), need to be implemented so that the quality of each item can be established. The Rasch Model is more promising than current procedures because it allows calibrated items to be given in any combination (item indices not a function of a particular test) to any group of students (item indices not dependent on a specific norm group).

In order to shorten the elapsed time between request and receipt of the materials and increase the accuracy of the requests, the materials should be stored in such a manner as to allow more ready access to particular sections of the files. It is necessary, with a large data file like COMBAT, to be able to identify relevant materials quickly and not spend computer time searching all stored materials. As the instructional development is completed, including systematic trials of all items, it might be possible to use the computer only to identify appropriate items or sets of items for specific learners to be printed in some fashion other than on the computer printer. While current computer hardware restrictions might prevent this from occurring, the idea needs to be investigated.

The problem of identifying the proper balance between development of new materials and the operation of the system needs to be clarified. Because of funding conditions placed on the project, adequate material had to be developed to provide real experience for large numbers of teachers from all sizes of districts. Since local districts were asked to finance the project after the expiration of federal funding, materials had to be developed of teachers at all grade levels. Had adequate funding been assured for an additional number of years, the materials would have been developed in systematic units of content rather than randomly processing materials contributed by teachers. Also, large scale utilization would have not begun until the materials were produced and tried.

Suggestions for Further Research

It has been suggested by persons served by the COMBAT Project that more complete instructional resources need to be created. They have recommended including learning activities with the instructional objectives and test items to form a more complete instructional package. This inclusion would require modification of existing materials and sequencing the instructional objectives into learning strategies. An additional problem would be to create activities that would be acceptable to a large number of districts and in-line with their curricular philosophies.

More adequate solutions must be found to the problems of analyzing test items in a computer-based system such as COMBAT. The Rasch Model of item analysis would appear to be particularly appropriate to a system which allows teachers to select any combination of items to meet their specific testing needs. However, this procedure alone will not satisfy all the item analysis needs of the system. Procedures suitable for criterion-referenced measurement need to be employed to refine items that are most appropriate for assessing the accomplishment of the specific instructional objectives provided by the COMBAT system. Eventually it would seem that several item analysis procedures should be employed to meet all the item analysis needs of a system like COMBAT. Further research is needed to clarify the relationships among the various item analysis procedures and to establish the purposes for which each is best suited.

COMBAT was originally designed to be a testing source serving in a traditional norm-referenced manner. Later, during implementation phase of the project, instructional objectives were included with each item.

This practice of storing test items with instructional objectives provided a potential for a criterion-reference testing emphasis which needs to be investigated further.

Testing people, who have influenced the project greatly, are interested in the potential of the COMBAT system as a diagnostic testing device. Using the system in this fashion it would be possible to correlate student achievement on items with some other measure of classroom success and use the system to pinpoint student strengths and weaknesses.

The ways that COMBAT can be incorporated with existing and emerging individualized instructional programs should also be studied. A fully developed system like COMBAT could serve as a master file for all curricular areas from which truly individualized instructional programs could be developed. The objectives and test items would serve as the beginning and end of an infinite number of instructional programs which could be developed.

Attachment A

Results of the COMBAT Test Request Questionnaire

--by Jim Walter

A questionnaire was presented to approximately 55 teachers in the greater Portland Area concerning their reactions to the type of service they had received when requesting, receiving and administering a COMBAT test. The responses on the questionnaire may be somewhat biased because the respondents were enrolled in the class, Measurement of Educational Objectives, taught by Dr. Gerald Gage. Efforts are now underway to receive information concerning the COMBAT operation from other users. The results of the questionnaire are summarized below:

1. The length of time to receive the first print out of a test averaged 8.4 days. This statistic is not meaningful because many requests were made immediately preceding Christmas vacation and not received until teachers returned from vacation. The mode seems more appropriate that it was 2 days.

2. When asked "Did you have trouble reaching COMBAT services by telephone?" 71% of respondents answered no. The type of problem encountered by the other 29% was a busy line.

3. The average time spent by teachers on the telephone to COMBAT SERVICES was 4.6 minutes. It should be noted that first requests from a teacher require more time than her second and subsequent requests.

4. When asked if the test had so many mistakes that its use would be restricted, 87% said no, the use of the test would not be restricted. Some of the mistakes teachers mentioned were: answers not accurate, misspelled items, irrelevant items and incorrect item formats.

5. The responses, to the question "Are the instructions to the student Clear?" all 55 teachers answered that the instructions seemed clear to them.

6. When asked if the teachers would use the items in their classroom, if they were relevant for the grade level they taught, 96% stated they would not hesitate to use the items in their classes.

7. The teachers were asked for suggestions to improve either the tests or the COMBAT service some of their responses follow:

    a. Heavier carbon for clearer copies.
    b. More items necessary in some areas of 4th, 5th and 6th grade social studies.
    c. Provide a catalogue of what is stored in the computer.
    d. Delay in arrival of items.
    e. Short answer items should all be complete sentences.

Attachment B

COMPUTER-BASED TEST DEVELOPMENT INDEX

(COMBAT)

Grades 1 - 12

E N G L I S H

The following outline represents subject-matter categories for which behavioral objectives and test items are being developed for teachers of social studies, language arts, science and mathematics. Because the COMBAT system is in the development stage, material has not been stored for all categories.

English

I. Composition

- A. Essays
- B. Letters
- C. News Items
- D. Organization
- E. Paragraph Development
- F. Reports
- G. Research Papers
- H. Stories
- I. (Types)

II. Grammar

- A. Capitalization
- B. Morphology
- C. Parts of Speech
- D. Punctuation
- E. Syntax

III. Library

- A. Book Classification
  - 1. Dewey Decimal System
  - 2. Library of Congress
- B. Books
- C. Facilities
  - 1. Audio-Visual Aids
  - 2. Card Catalogue
  - 3. Files
  - 4. Newspapers
  - 5. Periodicals
  - 6. Reserve Shelves

IV. Literature (include country of origin--Greek, English, etc.)

- A. Authors (Specific Names)
- B. Bible
- C. Drama
- D. Elements of
  - 1. Attitude
  - 2. Characterization
  - 3. Conflict
  - 4. Mood
  - 5. Point of View
  - 6. Setting
  - 7. Style
  - 8. Suspense
  - 9. Symbolism
  - 10. Tone
- E. Figures of Speech
- F. History
- G. Literary Devices
- H. Mythology
- I. Narrative
  - 1. Allegory
  - 2. Fable
  - 3. Parable
- J. Novels
- K. Poetry
- L. Prose
- M. Riddles
- N. Short Stories
- O. Structure
- P. Titles (Specific Titles)
- Q. Vocabulary

V. Reading Skills

- A. Phonetics
- B. Reading Comprehension

VI. Speech

- A. Composition
- B. Delivery
- C. Discussions
- D. Parliamentary Procedure
- E. (Types) of Speeches

VII. Spelling

VIII. Vocabulary

- A. Analogies
- B. Antonyms
- C. Etymology
- D. Homonyms
- E. Idioms
- F. Pronunciation
- G. Synonyms

COMPUTER-BASED TEST DEVELOPMENT INDEX

(COMBAT)

Grades 7-12 [redacted]

M A T H E M A T I C S

The following outline represents subject-matter categories for which behavioral objectives and test items are being developed for teachers of social studies, language arts, science and mathematics. Because the COMBAT system is in the development stage, material has not been stored for all categories.

HIGHER ARITHMETIC

I. Whole Numbers

- A. Addition
- B. Subtraction
- C. Division
- D. Multiplication

II. Common Fractions

III. Decimals

IV. Percentage

V. Squares, Square Roots

VI. Ancient, Non-Decimal Systems

VII. Measurements

VIII. Ration, Proportion

IX. Statistics

X. Business Math

- A. Income
- B. Expenses
- C. Interest, Commission
- D. Insurance
- E. Tax
- F. Stocks, Bonds
- G. Industrial Applications
- H. General Business
- I. Story Problems

ALGEBRA I

I. Symbols, Sets

- A. Sets, Subsets
- B. Numbers and their relationships
- C. Number Line
- D. Numbers in One or More Operations

II. Numerals and Variables

- A. Problems Solved with Variables
- B. Numerical Phrases

III. Axioms

IV. Equations (True, False, Open)

V. Sentences

- A. Analysis

VI. Negative Numbers

- A. Extending the Number Line
- B. Operations with Numbers
- C. Inverses

VII. Real Numbers

- A. Number Line Order
- B. Opposites
- C. Absolute Value
- D. Rational Numbers
- E. Irrational Numbers

VIII. Properties, Polynomials

- A. Addition
- B. Multiplication
- C. Order
  - 1. Equality
- D. Subtraction
- E. Division

IX. Factors, Exponents

- A. Distributive Property
- B. Quadratic Trinomials
- C. Extension
- D. Exponents, Properties

X. Fractions, Ratios

- A. Multiplication, Division
- B. Addition, Subtraction
- C. Open Sentences

XI. Graphs

- A. Ordered Pairs of Numbers, Points in a Plane
- B. Linear Equations
- C. Inequalities and Open Sentences
- D. Special
- E. Statistical

XII. Radicals

- A. Roots (Square Roots)
- B. Involving Fractions

XIII. Polynomials and Rational Expression

- A. Factoring
- B. Distributive Property
- C. Difference of Squares
- D. Algebraic

XIV. Sentences in Two Variables

- A. Linear Open Sentences
- B. Graphs with Two Variables

XV. Functions

- A. Selecting Pairs of Numbers
- B. Variations

XVI. Quadratic Equations

- A. Solutions

XVII. Equations and Inequalities

INTERMEDIATE MATHEMATICS

I. Number Systems
   - A. National Numbers
   - B. Integers
   - C. Rational Numbers
     1. Operations with Fractions
     2. Laws of Exponents
   - D. Decimal Numbers
   - E. Axioms

II. Coordinate Geometry
   - A. Linear Equations
   - B. Lines, Equations
   - C. Linear Inequalities

III. Polynomials
   - A. Products
   - B. Factoring
   - C. Division

IV. Functions
   - A. Notation
   - B. Linear
   - C. Graphs

V. Equations, Relations
   - A. Quadratic Functions
   - B. Real Roots, Radicals
   - C. Solutions
   - D. Quadratic Inequalities
   - E. Graphing Quadratic Relations
   - F. Solving Quadratic Systems

VI. Complex Number System
   - A. Polar Form

VII. Systems of Equations in Two Variables
   - A. First Degree
   - B. Second Degree

VIII. Systems of Equations in Three Variables
   - A. First Degree

IX. Exponential Functions, Logarithms

X. Trigonometry
   - A. Coordinates, Functions
   - B. Evaluating, Applying Functions
   - C. Identities Involving One Angle
   - D. Identities Involving Two Angles
   - E. Triangle Applications

XI. Circular Functions
   - A. Variations, Graphs
   - B. Inverse Functions, Graphs
   - C. Open Sentences

XII. System of Vectors

XIII. Progressions
   - A. Arithmetic
   - B. Geometric
   - C. Binomial Expansions

XIV. Sequences, Series

XV. Matrices
   - A. Operations
   - B. Algebra of 2X2
   - C. Linear Systems
   - D. Transformations of the Plane

XVI. Determinants

XVII. Permutations

XVIII. Combinations

XIX. Probability

XX. Differentiation

XXI. Integration

XXII. Slide Rule

GEOMETRY

I. Sets, Real Numbers

II. Induction

III. Deduction, Proof

IV. Angle Relationships

V. Points, Lines, Planes

VI. Triangles, Congruences

VII. Similar Polygons

- A. Right Triangles
- B. Pythagorean Theorem

VIII. Measurement of Arcs, Angles

IX. Constructions, Loci

X. Coordinate Geometry

- A. Relating Points, Numbers
- B. Distance
- C. Graphing of Lines
- D. Facts about Lines, Segments
- E. Proofs about Polygons

XI. Areas of Polygons, Circles

- A. Quadrilaterals, Triangles
- B. Regular Polygons
- C. Circles, Sectors, Segments
- D. Constructions

XII. Areas, Volumes of Solids

- A. Prisms, Pyramids
- B. Cylinders, Cones, Spheres
- C. Similar Solids

XIII. Ratio, Proportion

BASIC MATHEMATICS

I. Number

- A. Closure Principle
- B. Commutative Principle
- C. Associative Principle
- D. Distributive Principle
- E. Inverses
- F. Identities
- G. Integer Sequence
- H. Place Value
- I. Odd, Even Numbers
- J. Number Line
- K. Cardinal
- L. Ordinal
- M. Understanding one to ten
- N. Understanding Zero Through Millions
- O. Inequalities, Negative Numbers
- P. Exponents
- Q. Absolute Value
- R. Counting, Whole, Natural
- S. Ratio
- T. Rational, Irrational
- U. Percentage
- V. Mixed
- W. Decimals
- X. Fractions
- Y. Prime

II. Numerals and Numeration System

- A. Recognition of Numerals one to ten
- B. Reading and Writing Numerals Zero to Hundred
- C. Reading and Writing Numerals Zero to Thousand
- D. Counting by Ones
- E. Counting by Twos, Fives, Tens
- F. Counting by Threes, Fours, Sixes
- G. Number Bases
  1. Base ten
  2. Base eight
  3. (etc.)
- H. Place Value
- I. Roman Numerals
- J. Whole Numbers
- K. Rounding Numbers

III. Addition

- A. Union of Sets
- B. Properties
  1. Commutative
  2. Associative
- C. Two Digit Addends
- D. Three, More Digit Addends
- E. Story Problems
- F. Carrying

IV. Subtraction

- A. Set Separation
- B. Properties
  1. Non-Commutative
- C. One Digit Minuends
- D. Two, More Digit Minuends
- E. One Digit Subtrahend
- F. Two, More Digit Subtrahend
- G. Equations
- H. Inverse Relationship
- I. Borrowing
- J. Decimals
- K. Story Problems

V. Multiplication

- A. Repeated Addition
- B. One Digit Factor
- C. Two, More Digit Factors
- D. Equations
- E. Properties
- F. Story Problems

VI. Division

- A. Repeated Subtraction
- B. Missing Factors
- C. Sets
- D. Inverse Relationship
- E. One Digit Divisor
- F. Two, More Digit Divisor
- G. Equations
- H. Properties

VI. Division (Cont'd.)

I. Remainders

1. Whole
2. Fractional

J. Decimals
K. Story Problems

VII. Square Roots, Squaring

VIII. Factoring, Prime Factorization

A. Composite

IX. Multiples

X. Cube Roots, Cubes

XI. Measurements

A. Length
B. Closed Figures
C. Area
D. Volume
E. Time
F. Money
G. Weight
H. Congruence
I. Symmetry
J. Capacity
K. Units
L. Calendar
M. Story Problems
N. Accuracy, Errors
O. Probability
P. Statistics

XII. Relations

A. One, More, Less
B. Natural Order
C. Sequences, Series
D. Comparison
E. Equalities, Inequalities
F. Related Symbols
($<$, $>$, Σ, $=$)
G. Operation Symbols (+, $\cdot$, etc.)

XIII. Algebraic Representation

A. Mathematical Sentences
B. Equality, Inequality
C. Variables
D. Equations
E. Story Problems

XIV. Fractions

A. Set of Ordered Pairs
B. Understanding
C. Addition, Subtraction

1. Like
2. Unlike
3. Mixed

D. Multiplication
E. Division
F. Decimals
G. Ratio
H. Proportion
I. Percentage
J. Numerators
K. Denominators
L. Proper, Improper Fractions
M. Story Problems
N. Reciprocal

XV. Sets

A. Elements
B. One to One Correspondence
C. Subsets
D. Equivalent, Nonequivalent
E. Union
F. Interpret Subtraction
G. Empty, Null
H. Finite, Infinite
I. Intersection
J. Number Pairs
K. Story Problems

XVI. Geometry

A. Points
B. Lines
C. Planes
D. Shapes
E. Solids
F. Angles
G. Story Problems

XVII. Graphical Representation

A. Bar Graphs
B. Two Variables
C. Simple Functions
D. Line
E. Complex

XVIII. Proof

A. Experience
B. Estimation
C. Reduction
D. Induction
E. Deduction

XIX. Business Math

A. Planned Spending and Saving
B. Dollars, Cents, Values
C. Bank Procedures
D. Taxes
E. Insurances
F. Time, Cash Purchasing
G. Mortgages
H. Interest, Commission

COMPUTER-BASED TEST DEVELOPMENT INDEX

(COMBAT)

Grades 7-12

S C I E N C E

The following outline represents subject-matter categories for which behavioral objectives and test items are being developed for teachers of social studies, language arts, science and mathematics. Because the COMBAT system is in the development stage, material has not been stored for all categories.

EARTH SCIENCE

I. Chemistry

- A. Elements
- B. Compounds
- C. Decomposition
- D. Electrochemistry
- E. Mixture

II. Measurements

III. Geology

- A. Minerals
- B. Rocks
- C. Earth Movement
- D. Topography
- E. Soil Formation
- F. Erosion
- G. Running Water
- H. Glaciation
- I. Record of Earth History
- J. Hydrosphere
- K. Meteorology
- L. Climate
- M. Climatic Regions
- N. Seasons
- O. New Frontiers
- P. Gravity

IV. Astronomy

- A. Solar System
- B. Light Year
- C. Galaxies
- D. Constellations
- E. Celestial Sphere
- F. Formulas and Equations
- G. Movement of Cellestial Bodies
- H. Planets
- I. Newton and Kepler Laws
- J. Measurement of Celestial Objects
- K. Moon
- L. Sun
- M. Stars
- N. Space, Time, Life

V. Oceanography

- A. Wind, Waves
- B. Shore Lines
- C. Geology of Ocean
- D. Sediments
- E. Chemical Characteristics
- F. Marine Biology
- G. Sun and Sea
- H. Physical Characteristic
- I. History
- J. Circulation
- K. Measurement
- L. Equipment

VI. Inquiry (See Biology)

VII. Conservation

PHYSICS

I. Mechanics

- A. Kinematics
- B. Dynamics
- C. Statics
- D. Simple Machines
- E. Engines

II. Matter

- A. Solids
- B. Liquids
- C. Gases
- D. Energy

III. Measurements

- A. Metric System
- B. Graphs
- C. Instruments

IV. Heat

- A. Temperature, Expansion
- B. Transfer
- C. Radiant
- D. Vaporization
- E. Thermodynamics
- F. Gas Laws
- G. Kinetic Theory

V. Sound

- A. Vibration, Waves
- B. Hearing
- C. Tone

VI. Light

- A. Illumination
- B. Nature
- C. Reflection
- D. Refraction
- E. Eye and Optical Instruments
- F. Lenses
- G. Dispersion
- H. Color
- I. Diffraction
- J. Polarization

VII. Electricity

- A. Electric Field
- B. Storage of Electricity
- C. Ohm's Law
- D. Circuits
- E. Electric Energy, Power

VIII. Magnetism

- A. Magnets
- B. Magnetic Fields
- C. Magnetic Forces
- D. Electromagnets
- E. Lenz's law, Self Inductance
- F. Electromagnetic Waves

IX. Electronics

- A. Electron Tube
- B. Transmission of Electromagnets
- C. Transistors
- D. Terms
- E. Instruments

X. Atomic

- A. Elements, Isotopes
- B. Structure of Atom
- C. Continuous - Emission Spectra
- D. Atomic Spectra
- E. Atomic Radiation
- F. X-Rays
- G. Relativity

XI. Nuclear

- A. Radioactivity
- B. Radiation
- C. Disintegration
- D. Beta, Gamma Rays
- E. Fission, Fusion
- F. Reactors

INTRODUCTORY PHYSICAL SCIENCE (IPS)

I. Quantity of Matter: Mass

   A. Volume

II. Characteristic Properties

   A. Density
   B. Elasticity
   C. Temperature

III. Solubility and Solvents

IV. The Separation of Substances

V. Compounds and Elements

VI. Radioactivity

VII. The Atomic Model of Matter

VIII. Sizes and Masses of Atoms and Molecules

IX. Molecular Motion

X. Heat

CHEMISTRY

I. Organization

- A. Atomic Structure
- B. Structure of Atoms
- C. Period Law
- D. Concepts, Laws, and Theories
- E. History
- F. Processes

II. Measurements

III. Chemical Formulas

- A. Bonds
- B. Compositions
- C. Equations
- D. Symbols

IV. Physical States of Matter

- A. Gas Laws
- B. Molecular Composition of Gases
- C. Liquids, Solids

V. Solutions

- A. Water

VI. Ionization

VII. Acids, Bases, Salts

VIII. Suspensions

IX. Carbon

X. Electrochemistry

XI. Chemical Reactions

- A. Kinetics
- B. Equilibrium
- C. Oxidation, Reduction Reactions
- D. Stoichiometry
- E. Analysis
- F. Catalyst

XII. Metals

- A. Alkali
  - 1. Hydrogen
- B. Alkaline Earth
- C. Transition
- D. Properties

XIII. Rare Earths

XIV. Organic

- A. Classification
- B. Reactions
- C. Amino Acids
- D. Petroleum
- E. Polymerization

XV. Nuclear Reactions

- A. Radioactivity

XVI. Biochemistry

- A. Photosynthesis
- B. Digestion, Metabolism
- C. Enzymes
- D. Respiration
- E. Steady State
- F. Overnutrition, Anulnutrition
- G. Nitrogen Cycle

XVII. Problems Today

- A. Alcohol
- B. Drugs
- C. Tobacco

BIOLOGY

I. Inquiry

- A. Hypothesis
- B. Investigating Unknown Substances
- C. Sample Problems
- D. Measurements
- E. Microscopes
- F. Observation
- G. Conclusions
- H. Procedures
- I. Experiments

II. History

III. Classification

IV. Evolution

- A. Darwin's Theory
- B. Adaptations, Selections
- C. Spontaneous Generation
- D. Emergence of Life

V. Environment

VI. Chemical Energy

- A. Chemical Biology
- B. Cells
- C. Acids, Bases
- D. Enzymes
- E. Fermentation
- F. Photosynthesis
- G. Krebs Cycle
- H. Chlorophyll
- I. Respiration
- J. Stimulants
- K. Transpiration
- L. Decompositions

VII. Cell Structure

- A. Nucleic Acid
- B. DNA
- C. Protein Molecules
- D. RNA
- E. Mutations
- F. Genes and Enzymes
- G. Chromosomes
- H. Cell Division
- I. Mitochondria
- J. Water

VIII. Multicellular Organisms

- A. Competition
- B. Cooperation
- C. Reproduction, Growth
- D. Hormones

IX. Genetics

- A. Environment
- B. Work of Mendel, Others
- C. Probability
- D. Heredity
- E. Chromosome Theory
- F. Genes
- G. Hardy-Weinberg Principle
- H. Molecular
- I. Zygote

X. Energy Utilization

- A. Transport Systems of Plants
- B. Transport Systems of Animals
- C. Regulation of the Internal Environment
- D. Excretory Systems
- E. Cultures

XI. Unifying Systems

- A. Regulation in Plants
- B. Regulation in Animals
  - 1. Metabolism
- C. Thyroid Regulation
- D. Nervous Systems
- E. Skeletal
- F. Muscles
- G. Patterns of Behavior
  - 1. Learned
- H. Tendons
- I. Structures

XII. Higher Levels

- A. Human Species
- B. Populations
- C. Societies
- D. Communities
- E. Ecosystems

XIII. Diseases

XIV. Radioactivity

XV. One-Celled Organisms

- A. Cultures
- B. Molds

XVI. Botany

- A. Algae

XVII. Zoology

COMPUTER-BASED TEST DEVELOPMENT INDEX

(COMBAT)

Grades 7 - 12

S O C I A L S T U D I E S

The following outline represents subject-matter categories for which behavioral objectives and test items are being developed for teachers of social studies, language arts, science and mathematics. Because the COMBAT system is in the development stage, material has not been stored for all categories.

PACIFIC NORTHWEST

I. History

- A. Indians
- B. Explorers
- C. Settlement
  1. Mountain Men
  2. Fur Trade
  3. Cattlemen
  4. Missionaries
  5. Pioneers
  6. Government
  7. (Indian) Wars
  8. Settlers

II. Geography

- A. Topography
- B. Society
- C. Agriculture
- D. Industry
- E. Commerce

III. Indian Reservations

LATIN AMERICA

I. Geography

- A. (Universe - general geography applies)
- B. (Map Skills - general geography applies)
- C. Landforms
- D. Bodies of Water
- E. Climate

II. Industry

- A. Agriculture
- B. Forestry
- C. Fishing
- D. Mining
- E. Manufacturing
- F. Transportation
- G. Communication
- H. Business
- I. Fuels
- J. Labor
- K. Building Materials
- L. Natural Resources
  1. Wildlife
  2. Minerals
  3. Vegetation
  4. Water
  5. Conservation

III. Society

- A. Ethnic Groups
  1. Pre-exploration
  2. Post-exploration
- B. Population
- C. Cities
- D. Languages
- E. Education
- F. Religion
- G. Occupations
- H. Health
- I. Politics
- J. Commerce
- K. Recreation
- L. Living Standards
- M. Science
- N. Art
- O. Customs
- P. Class System
- Q. Reforms
- R. Writing
- S. Architecture

IV. History

- A. Pre-exploration
- B. Exploration or colonization
- C. Revolutions
- D. Post-revolutionary
- E. Wars
- F. Current History

UNITED STATES HISTORY

I. Exploration

II. Colonization

III. Revolutionary War (1763-1783)

IV. Articles of Confederation

V. Constitution

VI. Federalism (1788-1819)

VII. Sectionalism

VIII. Civil War

IX. Reconstruction

X. Westward Expansion

XI. Progressive Era

XII. World War I

XIII. Roaring Twenties

XIV. Depression

XV. World War II

XVI. Cold War

XVII. Current History

XVIII. Geography (For U. S. History)

XIX. Society

- A. Industry
- B. Cities
- C. Recreation
- D. Living Standards
- E. Class System
- F. Religion
- G. Commerce
- H. Customs
- I. Occupations
- J. Health
- K. Ethnic Groups
- L. Population
- M. Language
- N. Education
- O. Science
- P. Art
- Q. Mathematics
- R. Architecture
- S. Music
- T. Reforms
- U. Immigration
- V. Writing
- W. Art
- X. Music
- Y. Government

GEOGRAPHY

I. Universe, Earth

II. Map Skills

- A. Location
- B. Time
- C. Maps

III. Landforms

- A. Land Masses
- B. Topography

IV. Bodies of Water

- A. Salt Water
- B. Fresh Water
- C. Underground Water

V. Climate

- A. Weather
- B. Seasons
- C. Climatic Regions

VI. Natural Resources

- A. Wildlife
- B. Minerals
- C. Vegetation
- D. Water
- E. Conservation
- F. Land

VII. World Regional Geography

- A. Western Europe
- B. Africa
- C. Middle East
- D. Asia
- E. Pacific Islands
- F. Latin America
- G. Antarctica
- H. North America

VIII. United States Regional Geography

- A. Pacific States
- B. Mountain States
- C. Southern States
- D. Middle Atlantic States
- E. New England States

WORLD HISTORY

I. Pre-history

- A. Cave Man
- B. Periods

II. River Valley Civilizations

- A. Mesopotamia
- B. Phoenicia
- C. Palestine
- D. Hittites
- E. Persian Empire
- F. Egypt
- G. India
- H. China

III. Greece

- A. City - States
- B. Persian Empire
- C. Athenian Empire
- D. Hellenic League
- E. Macedonia
- F. Egypt
- G. Asia Minor

IV. Rome

- A. Etruscans
- B. Roman Republic
- C. Carthage
- D. Gracchus
- E. Civil War
- F. Roman Empire

V. Byzantine Empire

- A. Justinian
- B. Slavs
- C. Constantinople

VI. Medieval Period

- A. Teutons
- B. Franks - France
- C. Holy Roman Empire
- D. Vikings
- E. Crusades
- F. England
- G. France
- H. Germany
- I. Russia

VII. Renaissance

- A. Countries
- B. Exploration
- C. Hundred Years War
- D. Holy Roman Empire
- E. Renaissance

VIII. Early Modern Period

- A. European States
- B. Wars
- C. Colonies
- D. French Revolution

IX. Nationalism (19th Century)

X. Imperialism (19th-20th Centuries)

- A. Reasons, Nineteenth Century
- B. Colonies
- C. Alliances
- D. British Commonwealth of Nations

XI. World Conflicts (1913 -)

- A. World War I
- B. League of Nations
- C. Conferences
- D. Peace Pacts
- E. Depression
- F. Countries
- G. World War II

XII. Cold War

- A. United Nations
- B. Communism
- C. Trouble Spots
- D. Alliances, or Plans, or Conferences

XIII. Society

- A. Art
- B. Recreation
- C. Science
- D. Mathematics
- E. Cities-Towns
- F. Education
- G. Health
- H. Population

XIII. Society (Cont'd.)

I. Occupation
J. Music
K. Commerce
L. Business
M. Languages
N. Writing
O. Customs
P. Living Standards
Q. Class System
R. Architecture
S. Ethnic Groups
T. Religion
U. Inventions
V. Philosophy
W. Reforms

XIV. Industry

A. Agriculture
B. Manufacturing
C. Labor
D. Forestry
E. Fishing
F. Mining
F. Transportation

XV. Economics

A. Economic Systems
B. Government

XVI. Geography

A. Landforms
B. Bodies of Water
C. Climate
D. Natural Resources

XVII. Government

A. Military
B. Systems
C. Laws
D. Police
E. Constitutions
F. Taxes
G. Public Works
H. Coins
I. Politics
J. Colonies
K. Welfare
L. Foreign Relations
M. International Relations

UNITED STATES GOVERNMENT

I. Government

- A. Federal System
- B. Anarchy
- C. Nations
- D. Politics
  - 1. Political Systems
  - 2. Public Opinion
  - 3. Political Parties
  - 4. Elections

II. National (Government)

- A. Declaration of Independence
- B. Constitution
- C. Congress (Legislative Branch)
- D. Judiciary (for Judicial Branch)
- E. Executive Branch
  - 1. Presidency
  - 2. State Department of Foreign Relations
  - 3. Treasury Department
  - 4. Defense Department or Military
  - 5. Postal System
  - 6. Labor Department
  - 7. Commerce
  - 8. Interior Department
  - 9. Agriculture (See also Geography)
  - 10. Health, Education and Welfare (See also Modern Problems)
  - 11. Housing and Urban Development Department (See also Modern Problems)
  - 12. Transportation Department (See also Geography)
  - 13. Justice Department (See also Geography)
  - 14. Territories
  - 15. (Miscellaneous Agencies)

III. State Government

- A. State Constitution
- B. State Legislature
- C. (Names of States)
- D. State Judicial System
- E. State Administration
- F. State Finance
- G. Rural, Local Government
- H. Municipal Governments
  - 1. Cities
  - 2. Mayors
  - 3. Public Utilities
  - 4. Metropolis
  - 5. (Names of Cities)
  - 6. Police

IV. Statehood

MODERN PROBLEMS

I. Alcohol

II. Tobacco

III. Drugs

IV. Civil Rights (See also U. S. History, Economics)

V. Communism (See also U. S. History)

VI. Driver Education

VII. Family Life

VIII. Health - First Aid

IX. Urban Problems

ECONOMICS

I. Business Cycle

II. Economic Systems

III. Political-Economic Systems

IV. Government

V. Industry

VI. Business

VII. Marketing

VIII. Production

GENERAL SOCIAL STUDIES

I. Middle East

II. India - Pakistan - Tibet

III. Russia

IV. Asia

V. Netherlands

VI. Canada

VII. Africa

- A. Society
  1. Ethnic Groups
  2. Education
  3. Religion
  4. Languages
  5. Cities
- B. Geography
  1. Natural Resources
  2. Landforms
  3. Bodies of Water
- C. Government

Attachment C

COMBAT DATA FILE

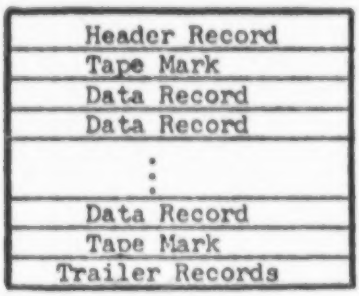
FIXED FORMAT

GENERATED ON A HONEYWELL 1250

TAPE IS:

7 tracks
556 BPI
Even Parity
BCD (Standard IBM Character codes)

The tape file has the following general record formats:



HEADER

The header record is an industry-standard 80 character record. The first five characters are "1HDRΔ" and are followed by a reel sequence number in positions 17 through 19 and a label identifier of "TRANSΔFILE" in positions 21 through 30. All other characters are unused.

TAPE MARK

The header record is followed by a single character tape mark record; the character being an "ƒ". (octal 17).

DATA RECORDS

The data records are unblocked and are either 499 or 999 characters (in decimal) in the data record, including the three character count itself.

The first three characters designate the total number of data characters (in decimal) in the data record, including the three character count itself.

The next twenty-six characters contain the record header and are always numeric:

9 characters designate the record identification number. The high order digit specifies the type of question contained in the data record.

High Order Digit	Type of Question
1	True and false
2	Matching
3	Multiple choice
4	Short answer
5	Essay

The remaining 8 digits are an assigned test item number.

The next 4 characters will always be "3102".

6 characters designate the date in month, day and year order (MMDDYY).

The remaining 7 characters are zero-filled.

The remainder of the record contains field identifiers and associated data. The field identifiers are 1-8 characters in length and identify the field to which the data following is to be associated. The data follows the identifier and is enclosed in parentheses. Following each data entry is a comma if another field identifier follows or a period if the end of the logical record has been reached.

Several observations need to be made regarding the field identifiers and associated data.

1. The data, although bound by parentheses, may contain any number of balanced parentheses within the data.
2. The field identifiers may be in any order within the data record.
3. Field identifiers may be omitted if associated data is absent; however, only the field identifiers listed below may be present in the data record.

Field Identifier	Definition
A	Author
L	Grade Level
S	Subject Matter Area
O	Objective
V	Verb
C	Keyword
I	Test Item
ANS	Answer
AUX	Auxiliary Item Numbers

TAPE MARK

The tape mark record follows the last data record and is one character in length; the character being an "ξ" (octal 17).

TRAILERS

The trailer records are industry-standard 80 character records. The first trailer record contains "1EOFΔ" in the first five characters and is followed by a reel sequence number in positions 17 through 19 and a label identifier of "TRANSΔFILE" in positions 21 through 30. This trailer record is followed by two more trailer records, each with "1ERIΔ" in the first five characters and each 80 characters in length. Only the positions specified are meaningful in the trailer records.

REQUIRES:

3-2400 ft. tape reels
30-min. computer time
COST-$75/set of three tape reels

```
EIFLEOF          A

 1 00001 0001 1=DR <<<<< "  1=001 TRANS FILE      <<<<<RQOBVEVLC<YZXY<7 A?1BPRZNX<197 <<<<<<<<<

   00002 0001 &

   00003 0001 313100031547310210016800000000A(PI HOUGHTON MIFFLIN COMPANY).L(6).S(ENGLISH).O(RECOGNIZE WHEN TO CHAN
         0101 GE THE SUBJECT IN A CONVERSATION.).V(RECOGNIZE).C(SPEECH. CONVERSATIONS).I(THE FOLLOWING IS A GOOD T
         0201 IME TO CHANGE THE SUBJECT IN A CONVERSATION.      THAT FRIEND OF YOURS IS THE SILLIEST BOY I EVER SAW
         0301 .).ANS(TRUE).*****************************************************************************************
         0401 *****************************************************************************************************

   00004 0001 305100031548310210016800000000A(PI HOUGHTON MIFFLIN COMPANY).L(6).S(ENGLISH).O(RECOGNIZE WHEN TO CHAN
         0101 GE THE SUBJECT IN A CONVERSATION.).V(RECOGNIZE).C(SPEECH. CONVERSATIONS).I(THE FOLLOWING IS A GOOD T
         0201 IME TO CHANGE THE SUBJECT IN A CONVERSATION.      HOW IS LEO.  I HEARD HE WAS IN AN ACCIDENT.).ANS(FA
         0301 LSE).*************************************************************************************************
         0401 *****************************************************************************************************

   00005 0001 318100031549310210016800000000A(PI HOUGHTON MIFFLIN COMPANY).L(6).S(ENGLISH).O(RECOGNIZE WHEN TO CHAN
         0101 GE THE SUBJECT IN A CONVERSATION.).V(RECOGNIZE).C(SPEECH. CONVERSATIONS).I(THE FOLLOWING IS A GOOD T
         0201 IME TO CHANGE THE SUBJECT IN A CONVERSATION.      WHY DONOT YOU GET NEW SKATES, BILL.  THOSE LOOK WOR
         0301 N OUT.).ANS(TRUE).************************************************************************************
         0401 *****************************************************************************************************

   00006 0001 314100031550310210016800000000A(PI HOUGHTON MIFFLIN COMPANY).L(6).S(ENGLISH).O(RECOGNIZE WHEN TO CHAN
         0101 GE THE SUBJECT IN A CONVERSATION.).V(RECOGNIZE).C(SPEECH. CONVERSATIONS).I(THE FOLLOWING IS A GOOD T
         0201 IME TO CHANGE THE SUBJECT IN A CONVERSATION.      I THOUGHT THE ASSEMBLY PROGRAM WAS GOOD. DIDNOT YOU
         0301 .).ANS(FALSE).****************************************************************************************
         0401 *****************************************************************************************************

   00007 0001 314100031551310210016800000000A(PI HOUGHTON MIFFLIN COMPANY).L(6).S(ENGLISH).O(RECOGNIZE WHEN TO CHAN
         0101 GE THE SUBJECT IN A CONVERSATION.).V(RECOGNIZE).C(SPEECH. CONVERSATIONS).I(THE FOLLOWING IS A GOOD T
         0201 IME TO CHANGE THE SUBJECT IN A CONVERSATION.      YOU THINK YOUORE GOOD AT SPELLING, BUT SAM IS BETTE
         0301 R.).ANS(TRUE).****************************************************************************************
         0401 *****************************************************************************************************

   00008 0001 328100031552310210016800000000A(PI HOUGHTON MIFFLIN COMPANY).L(6).S(ENGLISH).O(IDENTIFY CORRECT FORMS
         0101  OF INTRODUCTION.).V(IDENTIFY).C(SPEECH. INTRODUCTIONS).I(THE FOLLOWING IS THE CORRECT WAY TO INTROD
         0201 UCE TWO PEOPLE.      MILDRED, THIS IS MY COUSIN, JOHN ADAMS, OF BOSTON.  JOHN, THIS IS MILDRED PRICE,
         0301  MY BEST FRIEND.).ANS(TRUE).***************************************************************************
         0401 *****************************************************************************************************

   00009 0001 321100031553310210016800000000A(PI HOUGHTON MIFFLIN COMPANY).L(6).S(ENGLISH).O(IDENTIFY CORRECT FORMS
         0101  OF INTRODUCTION.).V(IDENTIFY).C(SPEECH. INTRODUCTIONS).I(THE FOLLOWING IS THE CORRECT WAY TO INTROD
         0201 UCE TWO PEOPLE.      UNCLE SETH, THIS IS MISS HOWE, MY SCOUTLEADER.  MISS HOWE, THIS IS MY UNCLE, MR.
         0301  COOPER.).ANS(FALSE).*************************************************************************************
         0401 *****************************************************************************************************

   00010 0001 839300030584310210016800000000A(BSCS).L(9, 10, 11, 12).S(SCIENCE).O(RECOGNIZE THAT THE DATA REPRESENT
         0101 ING INDIVIDUAL POPULATION COUNTS OF YEAST CELLS WOULD SHOW GREATER VARIATION THAN THE FOUR CLASS AVE
         0201 RAGES.).V(RECOGNIZE).C(CULTURES, REPRODUCTION, YEAST, ONE-CELLED ORGANISMS, BIOLOGY).I(IF THE POPULA
         0301 TION COUNTS OBTAINED BY EACH STUDENT IN ALL FOUR CLASSES WERE PLOTTED ON GRAPH 2015, ONE WOULD EXPEC
         0401 T THAT THE DATA REPRESENTING INDIVIDUAL COUNTS WOULD.      A, BE THE SAME AS THAT FOR THE FOUR CLASS
         0501 AVERAGE EXCEPT FOR THOSE STUDENTS WHO MADE ERRORS' B, SHOW GREATER VARIATION THAN THE FOUR CLASS AVER
         0601 AGES C, RESULT IN AN AVERAGE GROWTH CURVE WITH GREATER VARIATIONS THAN THE ONE PRESENTED D, YIELD A
         0701 MORE RELIABLE GROWTH CURVE FOR ALL FOUR CLASSES SINCE INDIVIDUAL COUNTS THAT VARIED FROM THE AVERAGE
         0801  COULD BE ELIMINATED).ANS(E).AUP(20.).*******************************************************************
         0901 *****************************************************************************************************
```

COMBAT DATA FILE

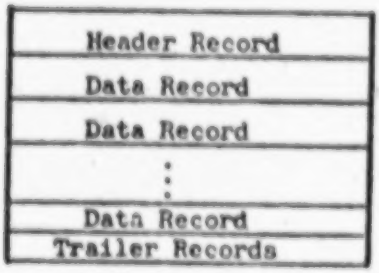
PRINT-IMAGE TAPE

GENERATED ON A HONEYWELL 1250.

TAPE IS:

7 tracks
556 BPI
Odd Parity
Standard Honeywell character codes.

The tape file has the following general record formats:



HEADER

The header record is an industry-standard 80 character record. The first five characters are "1HDR␣" and are followed by a reel sequence number in positions 17 through 19 and a label identifier of "TRANS␣FILE" in positions 21 through 30. All other characters are unused.

DATA RECORD

The print-image records are packed into blocks, the maximum block size being 1894 characters in length. Each block is preceded by one banner character, ≠(octal) 56 and a three character block length (in binary). There is a maximum of fourteen print-image records packed into one block.

Each print-image record is 135 characters in length, the first 2 characters specifying the length (in binary) record, the third character giving the printer control character, and the remaining 132 characters being the actual line image. Valid printer control characters will assume one of the following values:

1	Print, space 1 line
T	Do not print, space 3 lines
L	Print, space to head-of-form

TRAILERS

The trailer records are industry-standard 80 character records. The first trailer record contains "1EOFΔ" in the first five characters and is followed by a reel sequence number in positions 17 through 19 and a label identifier of "TRANSΔFILE" in positions 21 through 30. This trailer record is followed by two more trailer records, each with "1ERIΔ" in the first five characters and each 80 characters in length. Only the positions specified are meaningful in the trailer records.

REQUIRES:

3-2400 ft. reels
3-4-hrs. computer time
COST-$350/set of 3 reels

```
E1F1EOF          A
 1 00001 0001 1HLR          -001 TRANS FILE
   00002 0001 #G&O271*0001*                                    ALLR
         0101                                            271DIRECTIVE;
         0201
         0301   3102508   ALL                                                    271              PRINT
         0401          271ARGUMENT;
         0501                                                 271      13102
         0601
         0701                                                                          271       2
         0801                271       *   END
         0901                                                 271
         1001
         1101 *                  *-------------*                    *-------------*                      271*-----------
         1201                      271
         1301                                                      2711EOF
         1401                                                                                          271
         1501                              C O M B A T
         1601                        271
         1701                                                                  271100031551  01 OCT 68    0000
         1801                    (000/3102/508/0000001/T)
   00003 0001 #G&O271                                                                                              P
         0101                                          271GRADE-   6                    AUTHOR-   PI HOUGHTON MIF
         0201 FLIN                                                                          271
         0301             COMPANY                      VERB-    RECOGNIZE                SUBJECT-    ENGLISH
         0401          271
         0501                                          271OBJECTIVE-   RECOGNIZE WHEN TO CHANGE THE SUBJECT IN
         0601 A CONVERSATION.                                                                271
         0701
         0801                  271KEYWORDS-   SPEECH, CONVERSATIONS
         0901                                                 271
         1001                                                                                      2711TEM-   THE F
         1101 OLLOWING IS A GOOD TIME TO CHANGE THE SUBJECT IN A CONVERSATION.     YOU THINK YOU'RE GOOD AT SPELLI
         1201 NG, BUT SAM IS     271BETTER.
         1301                                                      271
         1401                                                                                          271ANSWER-
         1501   TRUE
         1601                        271
         1701                                                          271
         1801
   00004 0001 #G&O271                                    271
         0101
         0201                                                                  271
         0301
         0401          271                                C O M B A T
         0501                                          271
         0601
         0701  68    0000                                                                  271100031552   01 OCT
         0801                  271     (000/3102/508/0000002/T)
         0901                                          271GRADE-   6                    AUTHOR-   PI HO
         1001 UGHTON MIFFLIN                                                                271
         1101                          COMPANY                 VERB-    IDENTIFY                 SUBJECT-    EN
         1201 GLISH                 271                                                                 271
         1301                                                  271OBJECTIVE-   IDENTIFY CORRECT FORMS OF INTR
         1401 ODUCTION.                                                                                  271
         1501
         1601                              271KEYWORDS-   SPEECH, INTRODUCTIONS
         1701                                                                    271
         1801
```

Attachment D

COMBAT
COMPUTER-ASSEMBLED TEST

STUDENT NAME (.....)

TEACHER NAME (.....)

SCHOOL (.....)

DATE (.....)

THE FOLLOWING ITEMS ARE EITHER TRUE OR FALSE. WRITE EITHER TRUE" OR "FALSE" IN THE SPACE PROVIDED TO THE LEFT OF THE ITEM.

.....)1. THE CHILLED AIR ABOVE THE PERU CURRENT PRODUCES FOG, BUT LITTLE OR NO RAIN. THAT IS WHY THE WEST COAST OF PERU IS A DESERT. 100000414

.....)2. THE MOUNTAINS ALONG THE WEST COAST OF SOUTH AMERICA ARE THE ANDES. 100006458

.....)3. CHILE HAS THE LARGEST COPPER MINE IN THE WORLD. 100009302

.....)4. TWO LAND FORMS THAT ARE COMMON TO BOTH VENEZUELA AND COLOMBIA ARE THE ANDEAN HIGHLANDS AND THE LLANOS. 100009980

.....)5. ONLY RICH PEOPLE LIVE IN THE EUROPEAN COMMERCIAL ZONE. 100010195

THE FOLLOWING ITEMS HAVE FOUR POSSIBLE ANSWERS. SELECT THE NE YOU FEEL TO BE THE BEST ANSWER. PLACE THE LETTER OF THE BEST NSWER IN THE SPACE PROVIDED TO THE LEFT OF THE QUESTION.

.....)6. THE ANDES MOUNTAINS ARE LOCATED IN WHAT PART OF ARGENTINA. 300000498

A. EASTERN.
B. WESTERN.
C. SOUTHERN.
D. NORTHERN.

COMBAT
COMPUTER-ASSEMBLED TEST

.....)7. SELECT THE GEOGRAPHICAL CONDITIONS THAT ARE TRUE OF PERU. 300000508
A. 10-20 INCHES RAINFALL IN THE HIGHLANDS.
B. 20-40 INCHES RAINFALL IN THE HIGHLANDS.
C. 40-60 INCHES RAINFALL IN THE HIGHLANDS.
D. 60-80 INCHES RAINFALL IN THE HIGHLANDS.

.....)8. SELECT FROM THE FOLLOWING LIST THE ITEM WHICH BEST DESCRIBES THE PHYSICAL LAND FORM CHARACTERISTICS OF THE GUIANA'S COASTLINE. 300000733
A. HIGH AND RUGGED.
B. LOW AND ROLLING.
C. SWAMPY AND FLAT.
D. HIGH AND FLAT.

.....)9. THE GREAT RIVER THAT FLOWS EASTWARD THROUGH SOUTH AMERICA TO THE ATLANTIC OCEAN IS THE. 300009275
A. IQUITOS RIVER.
B. AMAZON RIVER.
C. SEINE RIVER.
D. HAITI RIVER.

.....)10. THE TIN CENTER OF THE AMERICAS. 300009300
A. BOLIVIA.
B. VENEZUELA.
C. PERU.
D. ECUADOR.

.....)11. THE EASTERN BOUNDARY OF BRAZIL IS. 300009319
A. THE ATLANTIC OCEAN.
B. THE PACIFIC OCEAN.
C. COLOMBIA.
D. CHILE.

.....)12. A GREAT RIVER IN SOUTH AMERICA IS THE. 300009591
A. AMAZON.
B. ORINOCO.
C. COLOMBIA.
D. NILE.

.....)13. TIERRA CALIENTE REFERS TO THE CLIMATE IN THE. 300009869
A. TROPICAL LOWLAND.
B. TROPICAL HIGHLANDS.
C. PIEDMONT BELT.
D. LEEWARD COASTAL LANDS.

COMBAT
COMPUTER-ASSEMBLED TEST

THE FOLLOWING ITEMS NEED TO HAVE AN ANSWER WRITTEN IN BY YOU. COMPLETE THE ITEMS BY PLACING YOUR ANSWER UNDER EACH OF THE ITEMS

14. NAME THREE REGIONS WHERE THE TRIBUTARIES OF THE AMAZON HAVE THEIR SOURCES. 400000216

15. GIVEN A RELIEF MAP OF SOUTH AMERICA (IF BOTH ATLANTIC AND PACIFIC OCEANS WERE TO RISE 600 FEET), WHAT HIGHLANDS WOULD BECOME ISLANDS. 400000282

16. GIVEN A RELIEF MAP OF SOUTH AMERICA (IF BOTH ATLANTIC AND PACIFIC OCEANS WERE TO RISE 600 FEET) WHAT FRACTION OF THE CONTINENT OF SOUTH AMERICA WOULD BE COVERED BY WATER. 400000283

17. MUCH OF THE SOIL OF THE SOUTH AMERICAN RIVER PLAINS WAS THE DIRECT RESULT OF THE OVERFLOWING RIVERS. SOIL THAT HAS BEEN CARRIED FROM THE HIGHLANDS TO THE LOWLANDS IS. 400009014

18. LIST THREE THINGS THAT THE COUNTRIES OF ECUADOR, PERU AND BOLIVIA HAVE IN COMMON. 400009514

COMBAT
COMPUTER-ASSEMBLED TEST

19. EASTERN PERU, WHICH IS PART OF THE AMAZON BASIN, IS CALLED THE. 400010002

20. LIST THE THREE REGIONS OF PERU. 400010217

21. PERU'S CHIEF AGRICULTURAL REGION IS THE. 400010681

THE FOLLOWING ITEMS CAN BE ANSWERED BY EITHER LISTING OR EXPLAINING YOUR ANSWER ON THE BACK OF THIS SHEET. NUMBER YOUR ANSWERS TO MATCH THE QUESTION NUMBERS.

22. EXPLAIN WHY BRAZIL'S INTERIOR IS SO SPARSELY POPULATED. 500009317

23. WHY ARE THERE SO MANY BIRDS ATTRACTED TO THE WATERS OFF THE PERUVIAN COAST. 500009902

24. YOU HAVE JUST INHERITED A 2,000 ACRE FARM IN THE MOUNTAINS OF VENEZUELA. WHAT DIFFICULTIES WOULD YOU HAVE IN FARMING THE AREA. HOW WOULD YOU OVERCOME THESE PROBLEMS. 500010159

25. EXPLAIN WHY THE COASTAL LOWLAND OF PERU IS ARID. 500010220

COMBAT
COMPUTER-ASSEMBLED TEST

ANSWER LIST

1.	TRUE	100000414
2.	TRUE	100006458
3.	TRUE	100009302
4.	TRUE	100009980
5.	FALSE	100010195
6.	B	300000498
7.	A	300000508
8.	C	300000733
9.	B	300009275
10.	A	300009300
11.	A	300009319
12.	B	300009591
13.	A	300009869
14.	GUIANA HIGHLANDS, WESTERN BRAZIL, CENTRAL HIGHLANDS, EASTERN SLOPE OF THE ANDES MT. RANGE	400000216
15.	THE GUIANA HIGHLANDS	400000282
16.	NEARLY HALF.	400000283
17.	ALLUVIAL SOIL	400009014
18.	HIGH ANDES MOUNTAINS, INDIAN PEOPLE, TRACES OF ANCIENT INCA CULTURE	400009514
19.	MONTANA	400010002
20.	COASTAL PLAIN, ANDES MOUNTAINS, PART OF THE AMAZON BASIN	400010217

COMBAT
COMPUTER-ASSEMBLED TEST

ANSWER LIST

21.	COASTAL LOWLAND REGION	400010681
22.	THERE IS POOR TRANSPORTATION TO THE INTERIOR, THE CLIMATE IS POOR, AND IT IS COVERED WITH DENSE GROWTH.	500009317
23.	THE BIRDS ARE ATTRACTED TO THE REGION BECAUSE OF THE AVAILABILITY OF FISH IN THE PERU CURRENT.	500009902
24.	SHORT GROWING SEASON, ROCKY, POOR SOIL, FREQUENT FROST, ACCESSIBILITY. RAISE LIVESTOCK AND GRASSES THAT ADAPT TO THE HIGH ALTITUDE, PRACTICE TERRACING, STRIP FARMING AND CONTOUR FARMING	500010159
25.	WINDS BLOW OVER THE COLD PERUVIAN CURRENT. THESE WINDS DON'T PICK UP LARGE QUANTITIES OF WATER. SINCE THE LAND IS HOT, THE MOISTURE ISN'T DROPPED UNTIL IT REACHES THE HIGH ANDES MOUNTAINS.	500010220

SOUTH AMERICA ELEVATION

COMBAT Aux. Mat.

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0485* COMBAT          RON HOFMANN          025RTEACHING RESEARCH
DIRECTIVE:
              PRINT       3102006    ALL
ARGUMENT:
         3102                    C(:VERBAL:(SOUTH AMER.(GEOGRAPHY * LANDFORMS))).
        *   END

*------------*                    *------------*                    *------------*

EOF
                                  C O M B A T (L.0)

00000333    08 FEB 68     0000                                (000/3102/006/0000217/T)

GRADE LEVEL (6)

OBJECTIVE: (IDENTIFY THE RELATIONSHIP BETWEEN TOPOGRAPHY AND TRANSPORTATION IN
SOUTH AMERICA.)

                                  C O M B A T (L.0)

00000414    08 FEB 68     0000                                (000/3102/006/0000218/T)

GRADE LEVEL (6)

OBJECTIVE: (IDENTIFY THE MAJOR GEOGRAPHICAL FEATURES OF PERU THAT EFFECTS THE
LIVING OF THESE PEOPLE.)

                                  C O M B A T (L.0)

00000496    20 FEB 68     0000                                (000/3102/006/0000219/T)

GRADE LEVEL (6)

OBJECTIVE: (IDENTIFY THE GEOGRAPHICAL REGIONS OF ARGENTINA.)

                                  C O M B A T (L.0)

00004824    01 OCT 68     0000                                (000/3102/006/0000220/T)

GRADE LEVEL (4. 5. 6)

OBJECTIVE: (IDENTIFY THE SEVEN CONTINENTS.)

                                  C O M B A T (L.0)

00006457    01 OCT 68     0000                                (000/3102/006/0000221/T)

GRADE LEVEL (6)

                        *------------*
                      * *** *  PAGE 008  * *** *
                RUN NO. 0485 *------------* RUN NO. 0485
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OBJECTIVE: (RECOGNIZE LANDFORMS IN MEXICO AND SOUTH AMERICA.)

C O M B A T (L.O)

100006458 01 OCT 68 0000 (000/3102/006/0000222/T)

GRADE LEVEL (6)

OBJECTIVE: (RECOGNIZE LANDFORMS IN SOUTH AMERICA.)

C O M B A T (L.O)

100007109 01 OCT 68 0000 (000/3102/006/0000223/T)

GRADE LEVEL (6)

OBJECTIVE: (RECOGNIZE GEOGRAPHIC FACTORS AFFECTING SAN MARTIN'S CAMPAIGN AGAINST THE SPANISH.)

C O M B A T (L.O)

100008767 01 OCT 68 0000 (000/3102/006/0000224/T)

GRADE LEVEL (6)

OBJECTIVE: (RECOGNIZE THE ANDES MOUNTAINS AS BEING THE HIGHEST MOUNTAINS IN SOUTH AMERICA.)

C O M B A T (L.O)

100008898 01 OCT 68 0000 (000/3102/006/0000225/T)

GRADE LEVEL (6)

OBJECTIVE: (RECOGNIZE THAT THE WESTERN COAST OF SOUTH AMERICA HAS VERY FEW NAVIGABLE RIVERS.)

C O M B A T (L.O)

100009302 01 OCT 68 0000 (000/3102/006/0000226/T)

GRADE LEVEL (6)

OBJECTIVE: (RECOGNIZE CHILE AS HAVING THE LARGEST COPPER MINE IN THE WORLD.)

C O M B A T (L.O)

100009305 01 OCT 68 0000 (000/3102/006/0000227/T)

GRADE LEVEL (6)

OBJECTIVE: (RECOGNIZE LA PAZ AS THE WORKING CAPITAL OF BOLIVIA WHILE SUCRE IS ITS LEGAL CAPITAL.)

C O M B A T (L.O)

100009306 01 OCT 68 0000 (000/3102/006/0000228/T)

GRADE LEVEL (6)

OBJECTIVE: (RECOGNIZE LA PAZ AS THE WORKING CAPITAL OF BOLIVIA WHILE SUCRE IS ITS LEGAL CAPITAL.)

C O M B A T (L.O)

100009307 01 OCT 68 0000 (000/3102/006/0000229/T)

GRADE LEVEL (6)

OBJECTIVE: (RECOGNIZE THAT LAKE TITICACA IS LOCATED IN BOTH THE REPUBLICS OF PERU AND BOLIVIA.)

C O M B A T (L.O)

100009351 01 OCT 68 0000 (000/3102/006/0000230/T)

GRADE LEVEL (6)

OBJECTIVE: (RECOGNIZE THE GREAT MOUNTAINS OF SOUTH AMERICA.)

C O M B A T (L.O)

100009352 01 OCT 68 0000 (000/3102/006/0000231/T)

GRADE LEVEL (6)

OBJECTIVE: (RECOGNIZE THE GREAT MOUNTAINS OF SOUTH AMERICA.)

C O M B A T (L.O)

100009904 01 OCT 68 0000 (000/3102/006/0000232/T)

GRADE LEVEL (6)

OBJECTIVE: (RECOGNIZE THAT THE PERU CURRENT AND THE HUMBOLDT CURRENT ARE THE SAME.)

C O M B A T (L•O)

100009970 01 OCT 68 0000 (000/3102/006/0000233/T)

GRADE LEVEL (6)

OBJECTIVE: (IDENTIFY THE LEADING EXPORT OF COLOMBIA.)

C O M B A T (L•O)

100009972 01 OCT 68 0000 (000/3102/006/0000234/T)

GRADE LEVEL (6)

OBJECTIVE: (IDENTIFY THE LEADING EXPORT OF ECUADOR.)

C O M B A T (L•O)

100009980 01 OCT 68 0000 (000/3102/006/0000235/T)

GRADE LEVEL (6)

OBJECTIVE: (RECOGNIZE TWO LAND FORMS THAT ARE COMMON TO BOTH VENEZUELA AND COLOMBIA.)

C O M B A T (L•O)

100010047 01 OCT 68 0000 (000/3102/006/0000236/)

GRADE LEVEL (6)

OBJECTIVE: (RECOGNIZE THE WAY LAND IS UTILIZED IN GUIANA.)

C O M B A T (L•O)

100010147 01 OCT 68 0000 (000/3102/006/0000237/T)

GRADE LEVEL (6)

OBJECTIVE: (RECOGNIZE PATAGONIA AS BEING AS FAR FROM THE EQUATOR AS NEWFOUNDLAND• THE PROVINCE OF CANADA.)

C O M B A T (L•O)

100010183 01 OCT 68 0000 (000/3102/006/0000238/T)

GRADE LEVEL (6)

BJECTIVE: (RECOGNIZE THAT THE INDIAN SUBSISTENCE CULTURAL ZONE CONTAINS MAINLY OOR FARMLAND.)

C O M B A T (L.O)

00010194 01 OCT 68 0000 (000/3102/006/0000239/T)

RADE LEVEL (6)

)BJECTIVE: (RECOGNIZE THAT THE EUROPEAN COMMERCIAL ZONE IS THE LEADING SHIPPING ND MANUFACTURING AREA IN SOUTH AMERICA.)

C O M B A T (L.O)

00010195 01 OCT 68 0000 (000/3102/006/0000240/T)

GRADE LEVEL (6)

)BJECTIVE: (RECOGNIZE THAT THE TERM "EUROPEAN COMMERCIAL ZONE" DOES NOT REFER TO THE TYPE OF PEOPLE WHO LIVE THERE.)

C O M B A T (L.O)

100010659 01 OCT 68 0000 (000/3102/006/0000241/T)

GRADE LEVEL (6)

OBJECTIVE: (RECOGNIZE THAT THE MOST IMPORTANT CROP OF THE MESTIZO CULTURAL ZONE IS COFFEE.)

END

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